

# MILITARY HOUSING CONSTRUCTION IN ALASKA

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## TWENTY-SECOND INTERMEDIATE REPORT OF THE COMMITTEE ON EXPENDITURES IN THE EXECUTIVE DEPARTMENTS<sup>1</sup>



DECEMBER 30, 1952.—Committed to the Committee of the Whole House  
on the State of the Union and ordered to be printed

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<sup>1</sup> Name changed to Committee on Government Operations, July 4, 1952.

<sup>2</sup> The Honorable Clare E. Hoffman, a member of the subcommittee, did not participate in the hearings which were held in Alaska and which form the basis of this report.

## LETTER OF TRANSMITTAL

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HOUSE OF REPRESENTATIVES,  
*Washington, D. C., December 30, 1952.*

HON. RALPH R. ROBERTS,  
*Clerk of the House of Representatives,*  
*Washington, D. C.*

DEAR MR. CLERK: I submit herewith the twenty-second intermediate report of the Committee on Expenditures in the Executive Departments.<sup>1</sup>

WILLIAM L. DAWSON, *Chairman.*

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<sup>1</sup> Name changed to Committee on Government Operations, July 4, 1952.

LETTER OF INTRODUCTION

I have the honor to acknowledge the receipt of your letter of the 10th inst. and in reply to inform you that the same has been forwarded to the proper authorities for their consideration. I am, Sir, very respectfully,  
Yours obedient servant,  
J. M. Smith



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82D CONGRESS  
2d Session

} HOUSE OF REPRESENTATIVES {

REPORT  
No. 2507

## MILITARY HOUSING CONSTRUCTION IN ALASKA

DECEMBER 30, 1952.—Committed to the Committee of the Whole House on the State of the Union and ordered to be printed

Mr. DAWSON, from the Committee on Expenditures in the Executive Departments,<sup>1</sup> submitted the following

### TWENTY-SECOND INTERMEDIATE REPORT

[Pursuant to H. Res. 736 (July 4, 1952), 82d Cong.]

On December 30, 1952, a Special Subcommittee Investigating Housing Construction in Alaska, of which Congressman Chet Holifield is chairman, submitted a report on Military Housing Construction in Alaska.

The Honorable Clare E. Hoffman, a member of the subcommittee, did not participate in the hearings which were held in Alaska and which form the basis of this report.

In accordance with permission granted the House on July 4, 1952, Chairman William L. Dawson submits the twenty-second intermediate report of the committee.

#### BACKGROUND OF SUBCOMMITTEE INQUIRY

In the spring of 1951, the Honorable Chet Holifield, a member of the committee, received information which indicated that construction of certain family housing units for military personnel in Alaska was characterized by slipshod methods, inferior materials, and lax supervision on the part of the Army Corps of Engineers, the Government agency responsible for Army and Air Force housing construction. This raised an immediate question whether the evident failure of the contractors to conform to contract plans and specifications as regards materials and workmanship was being met by change orders and adjustments in the contracts to prevent loss to the Government and unwarranted profit-making by the contractors. Accordingly, the information was turned over to the General Accounting Office for investigation.

<sup>1</sup> Name changed to Committee on Government Operations, July 4, 1952.

The Comptroller General, after study of the matter, sent investigators to Alaska to make an initial field investigation. In the meantime, by letter dated August 23, 1951, Mr. Holifield advised Gen. Lewis A. Pick, Chief of Engineers, that such an investigation was being made and requested the Corps of Engineers to withhold final acceptance and release of four designated contracts pending a report from the General Accounting Office.<sup>2</sup>

In a letter of reply dated September 7, 1951, General Pick acknowledged "errors and deficiencies in some of the work" and stated that the contractors responsible for those conditions had been notified to correct them. General Pick also stated that final payments would be withheld until corrections were made to the satisfaction of the district engineer in Alaska.<sup>3</sup>

Subsequently the General Accounting Office completed its report which was formally transmitted to Chairman Dawson on April 27, 1952.<sup>4</sup> In his judgment, the information contained therein warranted hearings in Alaska, and he thereupon designated Mr. Holifield as chairman of a special subcommittee. The press of legislative business compelled the subcommittee to defer proceeding to Alaska until the close of the session. However, on July 10, 1952, Subcommittee Chairman Holifield made oral inquiry of General Pick's office as to the status of the construction contracts in question. By letter dated July 28, 1952, Brig. Gen. John R. Hardin, Assistant Chief of Engineers for Military Construction, advised Mr. Holifield that all deficiencies in the four designated contracts either had been corrected or offsetting credits had been taken by the Federal Government.<sup>5</sup>

The subcommittee found through its hearings in Alaska that the information given by the Office of the Chief of Engineers was in some respects misleading. Also, the subcommittee found certain serious weaknesses in the administration of the housing-construction contracts by the district engineer in Alaska. The subcommittee is satisfied that its hearings in Alaska and the detailed inquiry it made in cooperation with the General Accounting Office will have a most salutary influence in discouraging or minimizing practices both by the contractors and the Corps of Engineers which are detrimental to the public interest and specifically to the military housing program in Alaska. At the same time, the subcommittee was afforded an excellent opportunity to examine housing construction in process or completed and to bring together pertinent information for the use of the Congress.

#### SCOPE AND VOLUME OF ALASKA MILITARY CONSTRUCTION

##### *Over-all construction*

The great volume of postwar military construction in Alaska is concentrated at Ladd and Eielson Air Force Bases in the Fairbanks area and at Elmendorf Air Force Base and Fort Richardson in the Anchorage area. World War II construction was mainly temporary (Quonset-type structures), with a small amount of permanent construction at Elmendorf and Ladd. The main wartime construction activity was centered in the Aleutian Islands.

<sup>2</sup> For text of letter see subcommittee hearings, *Military Housing Construction in Alaska*, p. 2.

<sup>3</sup> *Ibid.*, p. 2.

<sup>4</sup> The General Accounting Office report is printed in the subcommittee hearings, pp. 128 ff.

<sup>5</sup> The text of General Hardin's letter is printed in the subcommittee hearings, p. 3.

For the post-World War II period, military construction presently accomplished or programed through fiscal year 1953 represents approximate outlays of \$750 million. Although ultimate requirements are uncertain, the district engineer estimates that an additional \$400 million of work remains to be programed. Thus the cost of the military construction program in Alaska following World War II will exceed \$1 billion.

At the time of the subcommittee's visit, slightly more than \$300 million of military construction work had been accomplished, representing about one-third of the total postwar program for Alaska. Design work had progressed to a point approaching \$600 million worth of projects. The subcommittee found the design and construction work for specified fiscal-year programs in various stages of completion. The fiscal-1952 construction program was about 90 percent complete in design, between 10 and 20 percent complete in construction. Delays were attributed to tardy issuance of directives at the Washington level. Consequently, the fiscal-1953 program was piling on top of the preceding programs and multiplying the burdens of the district office.

The district engineer placed the value of contracts in the 1952 construction season at \$150 million and for the preceding construction season at \$139 million. He estimated that available facilities and resources would permit the placement of some \$200 million worth of contracts annually. Construction for the 1952 season involved about 90 contracts and 35 contractors. For the 1953 construction peak an estimated 12,000 construction workers will be needed by contractors. The district engineer expressed concern that the falling off in railroad, highway, and general building work in Alaska, causing a labor surplus in many crafts and trades in the Anchorage and Fairbanks areas, would discourage many workers from returning to Alaska next year.

#### *Housing construction*

The postwar military housing program in Alaska (fiscal 1946 through fiscal 1953) represents approximate outlays of \$212 million, comprising \$116 million for family quarters, \$20 million for bachelor officers' quarters, and \$76 million for enlisted men's barracks and dormitories. A portion of this program is completed; the remainder under construction or funded but not yet under contract.

Family housing, the largest component of the program moneywise, is approximately \$57 million completed, \$22 million under construction, and \$37 million funded but not yet under contract. These outlays represent 2,496 family units completed, 977 under construction, and 1,623 units programed but not yet under contract, a total of 5,096 units. The Air Force has 2,513 and the Army 2,583 of the total family units.<sup>6</sup> In terms of ultimate family-housing requirements for military personnel in Alaska, the 5,096 units represent probably 55 to 65 percent of the program.

#### DISTRICT ENGINEER ORGANIZATION AND OPERATION IN ALASKA

The office of the district engineer in Alaska is organized under the Chief of Engineers as an element of the North Pacific division, which has its headquarters in Portland, Oreg. The Alaska district is one of

<sup>6</sup> Permanent family units built before or during World War II are not included in these figures.



four in that division. The other three district offices are located at Seattle, Walla Walla, and Portland. The Alaska district presently is staffed with 19 military officers and approximately 1,200 civilian Government employees.

### *Engineering division*

Within the district office, an engineering division handles planning and design; a construction division administers the contracts, including field inspections of the work in progress.

All design and construction work is accomplished by the district engineer on the basis of specific directives issued by the Office of the Chief of Engineers, which, in turn, receives directives from the Departments of the Army and Air Force relative to their military construction requirements. Typically, a directive to the district engineer outlines what is to be built, design characteristics, specific limitations as to floor space, etc., and the quantity of funds allocated for the particular project. Upon receipt of the directive, the engineering division coordinates with the using service (Army or Air Force) in Alaska to determine that requirements are adequately described. Specific operating data and field information are obtained and then a lump-sum contract is made with an architect engineer firm for purposes of design.

According to the district office, three architect-engineer firms are initially selected and recommended to higher authority. The district recommendation is usually accepted, and then negotiations are undertaken with the preferred firm. After a design contract is awarded, preliminary plans are drawn up and reviewed by the district office, then the architect-engineer proceeds to make finished drawings and specifications which are checked and approved by the district office;

In the case of repetitive structures—houses, barracks, warehouses—the architect-engineer is paid for a single basic design which becomes the property of the Government. The architect-engineer provides the design, drawings, and technical sections of the specifications covering the construction. Administrative specifications are prepared in the district office as well as bidding documents, and a call is issued for bids based on these plans and specifications. All construction work in the Alaska district is handled on a lump-sum contract basis after competitive bidding.<sup>7</sup> Incoming bids are analyzed; the low bidder determined, and the contract awarded.

After award, principal responsibility passes to the construction division for contract administration and work in the field.

### *Construction division*

The construction division controls three project branches headed by project engineers. The latter oversee and assist resident engineers who have operating responsibility at the site after contract award. There are resident engineers at the various project areas in Alaska. The two large residencies at Ladd-Eielson and Fort Richardson function, in effect, as smaller district offices.

Where basic design changes or other modifications involving money differences are made in the field, these require approval by the district office. Otherwise, the resident engineer supervising the project is

<sup>7</sup> From 1946 to June 1949 practically all construction work in Alaska was performed on a cost-plus-fixed-fee basis by three contractors in a joint venture. This contract ran through more than \$100 million before it was canceled in 1949 (S. Doc. 10, 82d Cong., 1st sess., p. 7).

authorized to approve changes. In the normal procedure, agreements between the contractor and the Government involving money differences are embodied in formal change orders, adjusting the lump-sum contract price to reflect the differences. In the event agreement cannot be reached in the district, the contractor can submit a claim to the Office of the Chief of Engineers in Washington. A number of contractors' claims were pending on housing construction contracts investigated by the subcommittee.

#### *Government-furnished facilities*

Construction contractors recruit their own labor, but the Government operates construction camps for housing and messing of contractor employees at four major bases (Ladd, Eielson, Fort Richardson-Elmendorf, and Whittier). These camps are operated by a private firm for the Government on the basis of a single cost-plus-fixed-fee contract, the only one of its kind in the district.

The Government also maintains concrete batching and mixing plants at these four bases. The plants are operated under separate contracts for the purpose of supplying concrete to the various contractors. Only ready-mix concrete is supplied; concrete blocks utilized in some of the construction are fabricated in local block plants.

Other Government-furnished property, in the case of family housing, includes kitchen ranges and refrigerators.

Construction equipment owned by the Government and estimated by the district office at \$20 to \$25 million in value, is rented to contractors when available and requested.

#### *Surplus construction equipment*

The subcommittee understands that huge quantities of construction and other equipment and materials have accumulated in the district without being actively needed or used. The district engineer stated that following World War II, in anticipation of a major construction program in Alaska, large amounts of construction material and equipment were assembled from the Pacific islands and brought to Anchorage and Fairbanks. During the acute postwar shortage, such equipment was furnished to contractors in operable condition as an added incentive for them to work in Alaska. At present, Government equipment is furnished on an as-is, where-is basis, for which contractors pay commercial rentals with allowances for repairs.

In the opinion of the district engineer, Government rental of equipment has reached a point of diminishing returns. The property has been impaired by long exposure or obsolescence; much of it consists of broken lots in need of extensive repairs. The subcommittee believes that immediate steps should be taken to identify all the engineer-held property and to move it into channels of use within the Government or else to dispose of it as surplus.

#### FAMILY QUARTERS FOR MILITARY PERSONNEL IN ALASKA

The shortage of housing in Alaska has received wide publicity in the past few years and considerable attention from the Congress and the Department of Defense. Exorbitant rents, overcrowded and unsanitary quarters—these have been the lot of many families, military and civilian, stationed in the Territory. Lack of housing has



been regarded as a major obstacle to the deployment of ground troops and the proper build-up of Alaska defenses. However, substantial appropriations by the Congress and the present program of the Armed Forces for Alaska housing are overcoming these conditions.

The Congress, resisting the military inclination to self-indulgence in the matter of family housing standards, has set over-all cost limitations per family unit<sup>8</sup> and has prescribed maximum allowable floor space of 1,080 square feet.<sup>9</sup> These limitations induced the Army in 1949 to reduce its criteria for Alaska housing, making them accord more nearly with FHA standards. In November 1949, the district engineer was given revised criteria and directed to design two types of row housing, one consisting of eight 3-bedroom units and the other of eight 2-bedroom units. A Juneau architect-engineer firm was selected for the design work.

#### *Defense Housing Commission survey*

About this same time a Department of Defense Housing Commission was appointed to study family housing for military personnel. The Commission was requested by the Secretary of Defense to study proposed housing in Alaska and decide upon the design of a house suitable for use in the Territory. After a visit to Alaska, the Commission submitted a report dated January 14, 1950, which recommended that structures be of the multifamily type, with living room, dining alcove, and kitchen on the first floor, bath and three bedrooms; or bath, two bedrooms and utility room (alternating) on the second floor, with storage space for each unit to be provided in the attic. Maximum area of any unit was not to exceed 1,080 square feet gross, based on outside dimensions. The Commission recommended against construction of basements, finding their cost entirely out of proportion to utility.

The Defense Housing Commission also found that the Army-Air Force standard NCO (non-commissioned officer) type family quarters originally contemplated for the Alaska housing program were considerably more expensive in design and space allowance than FHA rental housing occupied by civilian American citizens having comparable income and status. It was noted that the three services, in conjunction with the Corps of Engineers, had taken measures for downward revision of design and space requirements, but the Commission was not satisfied that the indicated revisions were sufficient to meet the criteria recommended by it and approved by the Secretary of Defense in December 1949.

Expressing the conviction that construction costs in Alaska could never be brought down to the level of those in the continental United States, the Commission nevertheless believed that a material reduction of unit costs could and must be made. Such reductions were considered obtainable through the use of more flexible plans and specifications and through the assumption by the Government of responsibility

<sup>8</sup> Appropriation laws since 1949 have specified that outside the continental United States and in Alaska, the average cost per family unit is not to exceed \$25,580 and no individual unit is to exceed \$35,000 (63 Stat. 1020, 65 Stat. 446, 66 Stat. 533). Public Law 564, 81st Cong., 2d sess., an authorization bill for Army construction, limited such family quarters to \$29,500 and \$33,000 for average and unit costs respectively, including collateral costs of design, utilities, etc. (64 Stat. 244).

<sup>9</sup> Public Law 626, 80th Cong., 2d sess. (62 Stat. 380), prescribed a maximum of 1,080 square feet for family units of enlisted men, increasing the allowable space with rank up to 2,100 square feet for general officers. A 10-percent increase in these dimensions was permitted for family housing outside the continental United States. However, the same law as well as a later one (Public Law 564, 81st Cong., 2d sess., 64 Stat. 244) limited all family units built with funds from these authorizations to 1,080 square feet. Public Law 155, 82d Cong., 1st sess., allowed a maximum net floor area of 1,250 square feet for family quarters therein authorized, provided that the average of 1,080 square feet was maintained (65 Stat. 365).

for procurement and delivery of materials needed by contractors. The Commission registered the carefully considered opinion that construction costs at Kodiak and Anchorage areas could be held well within \$17.50 per square foot and in the Fairbanks area within \$20 per square foot. It recommended that private architects and engineers should be employed by the Corps of Engineers to prepare detailed plans and specifications and to supervise construction. These architects and engineers were to have the same discretion in selection of materials and modification of design as was customarily accorded architects and engineers serving private clients.

The Defense Housing Commission directed that bids be taken on five different housing plans. In May 1950, the Secretary of Defense approved for construction the so-called type A house, a 3-bedroom and basement unit designed by the Juneau firm.<sup>10</sup> This is the standard design for NCO-type housing constructed at Eielson, Ladd, and Elmendorf Air Force Bases and at Fort Richardson. Subsequently the same firm was retained to design several other types of housing for commissioned officers of different ranks; also family quarters at Whittier adequate to bear heavy snowfalls. According to a summary obtained from the district engineer design fees paid to this firm total slightly in excess of \$57,000.

#### SUBCOMMITTEE OBSERVATIONS ON ALASKA HOUSING

The subcommittee has briefly reviewed the background developments in Alaska family housing to point up its own observation that this program appears to be marked by trial and error and considerable lack of expert knowledge as to the most suitable housing design, materials, and construction methods to meet economy demands and military needs. Several of the Defense Housing Commission's major recommendations for Alaska housing were found inadvisable for one reason or another. For example, the Commission opposed basement construction because it believed the cost was excessive, but basements have been included in all family units. It was pointed out to the subcommittee that inclement weather in Alaska makes a basement a virtual necessity for recreational and domestic purposes.<sup>11</sup>

Again, the Commission was very firm in its belief that Government procurement and supply of building materials would effect substantial economies. The subcommittee was advised by the district engineer that under the lump-sum contract, construction can be performed more effectively when the contractor is responsible for procuring his own materials. Difficulties in Government procurement, warehousing and supply in the Territory, as well as in property accountability, were stressed by the district engineer. He preferred to cope with the problems of inspection of contractor-purchased supplies than with the problems of direct Government purchase, storage, and issue.

#### *Cost data*

It is uncertain from available cost data that the Commission's recommendations concerning cost limits per square foot have been

<sup>10</sup> One of the reasons for delay in Alaska housing, according to the Senate Preparedness Subcommittee, "was considerable slowness in developing a design for a standard house that was finally approved for Alaska" (S. Doc. 10, 82d Cong., 1st sess., p. 9).

<sup>11</sup> The subcommittee also found that in some instances the basement afforded a convenient arrangement whereby a commissioned officer would allow an enlisted man and his wife to occupy the basement in return for assistance with the housekeeping. In a civilian FHA project occupied by military and civilian personnel, basement space was provided in part for garages.

fulfilled. The Commission expressed a very decided opinion that no construction contracts should be let where costs per square foot exceeded \$17.50 in the Anchorage area and \$20 in the Fairbanks area. Figures submitted to the subcommittee by the District Engineer estimated square-foot costs for family housing at Fort Richardson (eight-family, row-type) to be \$20.86 on a net area basis. Costs in the Fairbanks area should be somewhat higher. However, an estimate supplied by the Chief of Engineers' Office shows a cost of \$15.26 per square foot, figured on a gross area basis and including all collateral costs, for a family housing project at Eielson.

Interestingly enough, square-foot costs for enlisted men's barracks and bachelor officers' quarters (40-man buildings) were higher than for family units. The barracks costs ranged from \$21.20 per square foot for 500-man barracks to \$34.10 for 198-man airmen's dormitories.

It should be noted, however, that square-foot cost estimates vary, depending on whether they are calculated on the basis of usable space, or inside or outside dimensions. Differences in the type of structure and the time of construction also affect cost comparisons.

Data extracted from the files of the Chief of Engineers' Office show family housing unit costs (as of August 31, 1951) ranging from approximately \$13,500 to \$17,000 at Fort Richardson and from \$18,000 to \$22,500 at Ladd and Eielson. Adding 8 to 15 percent to these unit costs to take account of area utilities, it appears that they are well within the statutory limitations. Although it is extremely difficult to establish an accurate ratio of construction costs in Alaska to stateside costs, the subcommittee is inclined to believe that the military services have overstated this ratio in presenting their budget justifications (at times the ratio of 3 to 1 has been cited). To prevent backsliding on economy objectives, a reexamination of the basis for establishing maximum cost limits on family housing units in Alaska would seem to be in order.

#### *Criticism of housing design*

The Defense Housing Commission's recommendation that private architects and engineers be employed to design the housing and be allowed wide discretion in preparing plans and specifications has been followed, but the results are not particularly impressive in the case of Alaska housing. One Alaska firm has been retained for all family housing design work, assertedly because of its experience with local conditions and requirements. However, the subcommittee observed some notable departures from economy in the design work. The district engineer seemed disposed to accept the technical specifications of the architect-engineer without careful evaluation of more economical alternatives.

One example immediately noted by the subcommittee was the use of reinforced concrete in the building foundations. This item was specified by the architect-engineer and accepted by the district engineer in the belief that concrete block, a cheaper material, was not suitable for Alaska because of seismic forces, ground water conditions, and labor costs of laying the block. In a later contract for 664 housing units, the low bidder submitted an alternate proposal for using concrete block instead of reinforced concrete, which offered a saving of some \$42,000 over the next bidder on that particular project. The low bid was accepted after the district engineer was finally convinced that concrete block could be satisfactorily utilized for Alaska housing.

Use of concrete block in place of poured concrete throughout all housing projects would have saved substantial sums of money.

Another example noted by the subcommittee was the use of striated plywood to cover portions of the outside walls on family housing projects inspected by the subcommittee. This material had been included in the specifications and accepted by the district engineer in an effort to introduce an element of variation in the appearance of the housing. Asbestos shingles, a cheaper and satisfactory exterior covering had been used in a number of units. By applying the striated plywood to the lower half and asbestos shingles to the upper half of the outside walls, it was sought to relieve somewhat the monotonous appearance of housing which consisted of rows of boxlike structures.<sup>12</sup> As we note below, the alleged difficulty of procuring striated plywood for a large number of units led to the substitution of an untested material called Welchboard which proved to be unsatisfactory. The subcommittee believes that the use of the more expensive material was hardly justified in the light of the ensuing difficulties that beset the district engineer or the meager esthetic results obtained. Asbestos shingles which were available would have served the purpose adequately.

Although the chief of the engineering division in the district office emphasized that the housing design in use was hurriedly prepared in response to urgent demands, the fact remains that the Alaska housing problem was one of long standing, and considerable time and effort had been expended over the years in trying to decide what kind of housing should be built.

#### *Lag in utilities*

Aside from questions raised by specification of certain materials in the housing design, the subcommittee is concerned as to whether over-all project planning is achieving the maximum economy. Urgency and speed have been cited to justify mistakes made and higher costs; yet the rush to build housing units for which utilities are not available is doubly wasteful. Completion dates for utility projects have lagged behind those for the housing projects intended to be served. Considerable sums have been lost to the Government because lack of utilities prevented beneficial occupancy for varying numbers of months. The subcommittee recognizes that separate appropriations for housing and utilities sometimes have complicated this matter. It is of the utmost importance that planning, budgeting, and appropriating for Alaska housing be integrated to insure the proper phasing of all elements necessary to the completed project.

#### *Permafrost footing problems*

In the Fairbanks area it appeared to the subcommittee that excessive costs were engendered by removing too much of the original soil from whole areas to be occupied by housing and backfilling with gravel. It is understood, of course, that these structures are being built in a so-called permafrost area, where the ground is permanently frozen or subject to freezing. According to the district engineer, subsequent heat of building structures would thaw the subsoil under the building, and the resulting soupy mass would be an unstable footing. Conversely, if buildings should go through a winter without

<sup>12</sup> The Defense Housing Commission had recommended that monotony in appearance of structures be prevented as far as possible through design of site plans.



heat, this material would freeze because of low temperatures existing in the area (up to maximum  $-70^{\circ}$  F.) and heavy damage would result to structure through heaving action.

Frost-susceptible material at the housing site was removed to a depth of 6 feet or more below footings and backfilled with gravel. On one contract alone for family quarters at Ladd Air Force Base, a change order added more than \$1 million to the amount of the contract because of additional work involved in excavation of unsuitable foundation material, procuring and hauling of gravel, and compacting the required backfill. Modifications of five contracts involved additional sums for excavation totaling approximately \$2,700,000. Since the backfill to a depth of 6 feet or more is capable of taking 5,000 pounds per square foot, that general figure has been used by the district engineer's office as a design approach for footing calculations. The subcommittee was unable to determine whether in fact the plans showed a 5,000-pound bearing requirement. For the housing in question, small, two-story frame, flat-roofed buildings, the requirement would appear to be unduly excessive.

Furthermore, the subcommittee is not convinced that the indicated depth of excavation is necessary. Information was given to the subcommittee that private construction in Fairbanks removed much less of the poor material. Reportedly, the five-story masonry post office in Fairbanks was built by removing about 18 inches of this material from the footing area, filling with good gravel, and pouring the footing on it. How accurate this information is, the subcommittee is unable to say. It suggests the need for a careful examination of the footing problems in the permafrost area to determine whether unrealistic bearing requirements are followed and excessive excavation undertaken; also whether proper insulation under buildings might be devised to minimize the amount of frost-susceptible material to be removed.

#### *FHA housing*

In general, the subcommittee has the impression that there is an uneven approach to the austerity goal in Alaska housing. True, the military services have been compelled to forsake their earlier expensive notions of what constituted appropriate family quarters. The NCO-type housing in use for officers as well as enlisted men, and limited to 1,080 square feet in size, certainly is economy housing. At the same time, the subcommittee inspected privately constructed FHA housing in Alaska which is more austere than the military housing but which still affords quite satisfactory and attractive quarters. In the FHA project no unit has more than two bedrooms while the completed military units have three. Although observing the 1,080-square-foot limitation, the military services decided to get the maximum number of bedrooms. The difference in cost between one-, two-, and three-bedroom housing is substantial. Had the services made some effort in their original planning to relate the housing units to family size, the over-all cost of housing construction would have been considerably reduced.

Presently a few units are being constructed or programed which have one and two bedrooms; however, the objective is not economy but to enable simultaneous construction of some 1,250-square-foot units with possibly four bedrooms as permitted by recent law so long as the 1,080-square-foot average limitation over all is maintained.

In connection with the FHA rental housing mentioned above, the subcommittee enters a reminder that the same taxpayers who support the military housing program also underwrite the private housing venture. Consequently, it behooves the military services to take careful account of the availability of outside housing in programing their own construction. A 418-unit FHA project in the Anchorage area, constructed on land leased from the military, gives priority to military personnel in occupancy. The subcommittee was advised that military personnel tend to rent quarters at the FHA project for a short period upon arrival, while waiting for military housing to become available. The private project therefore is exposed to unusually high turn-over and frequent vacancy, jeopardizing its solvency. It is recognized that a number of complex matters are involved, including the relationship of rental rates to the quarters allowance for military personnel. The subcommittee does not propose a specific solution but suggests that the possibilities of lease or purchase of the FHA project by the military services be examined.

The subcommittee also suggests that consideration be given to devising a cost accounting system for military housing that will identify all housing costs incurred, including maintenance.

#### SUBCOMMITTEE EXAMINATION OF SPECIFIC HOUSING PROJECTS

In cooperation with the General Accounting Office the subcommittee made a detailed examination of four housing projects which had deficiencies originally reported to Subcommittee Chairman Holifield. The contracts involved 145 eight-family structures or 1,160 individual family units at Fort Richardson. In this type of row-house structure, each dwelling includes a combination living room-dining room and kitchen on the first floor, two medium and one smaller-sized bedrooms and a bathroom on the second floor. Interior wall and ceiling finish are painted plaster board. Each unit is provided with a separate basement. The eight-unit buildings are flat-roofed, frame, two-story structures on reinforced concrete foundations and divided by reinforced concrete walls. For architectural effect the exterior is finished in part with asbestos shingles and in part with Welchboard (substituted for striated plywood on two contracts). Heating for the units is provided from an activated central steam plant.

Contractor performance on one of the four contracts examined was unusually poor. The effort of the contractor to cut corners and to use substandard materials and workmanship in violation of his contract is reprehensible, to say the least. At the same time, the district engineer must accept responsibility for permitting such practices to continue for substantial periods of time because of inadequate supervision and inspection.

#### *Use of Welchboard*

When this contractor represented to the district engineer that striated plywood, specified in the contract, was impossible to obtain, and requested permission to use a substitute, the district engineer made only a casual effort to verify the contractor's allegations of scarcity. The chief of the construction division, asserting that "\* \* \*" it has been our practice to track these things down wherever possible," recalled having made a telephone inquiry, but he was rather vague

as to the sequence of events and could not testify whether striated plywood actually was available or not at the time required.

In the course of considering possible substitute materials, the contractor suggested the use of Welchboard, a plywood having a face of waterproof, resin-fused wood plastic. He noted, however, that three coats of paint or spar varnish would be necessary to coat the material. Since the specifications for striated plywood called for a single coat of stain, the district engineer apparently was reluctant to have more done with the substitute. He undertook to wire the manufacturer of Welchboard, asking about coating requirements, and received a reply to the effect that satisfactory results had been obtained with the application of one coat of a certain kind of stain. In this case, it appeared that the district engineer was willing to take the word of the contractor as to the unavailability of striated plywood but was unwilling to take his word that the Welchboard required the application of three coats of paint or spar varnish.

After 1 year of exposure to the weather, and in some cases even less, serious surface ruptures and cracks appeared in the Welchboard, and in addition many panels showed a tendency to buckle and curl, in some instances sufficiently to draw the nails, particularly on the sunny side of the building. Large portions of the damaged Welchboard siding were replaced, but even the new panels showed the same signs of surface rupturing and cracking. The subcommittee saw numerous instances of these conditions and noted that the Welchboard did not present a pleasing appearance.

In October 1950, when it finally became apparent to the district office that one coat of finish was not achieving the desired results, the chief of the construction division advised the resident engineer that a two-coat job was required. It was not until April 1951—6 months later—that the resident engineer passed on this information to the contractor. The contractor refused to accept responsibility for the unsatisfactory condition of a substitute material initially approved by the district engineer, and the latter was unwilling to expend more Government funds for an additional coat of paint on the substitute when the original specifications called for a single application on striated plywood. The resident engineer recommended that some action be taken against the manufacturer of Welchboard for misrepresenting the material to the district engineer, but what form this action should take he was unable to say.

The subcommittee believes that the district engineer did not act with reasonable prudence in making an initial investigation of the substitute material and deciding as to its suitability. The chain of difficulties started with the architect-engineer who, in search of some architectural variation, specified striated plywood without considering its market availability.<sup>13</sup> When the contractor alleged his inability to obtain it, the district engineer was moved to adopt a substitute which had not been tried or tested in the Territory; he let it be applied with a single coat of paint on the basis of an off-hand statement by the manufacturer; and once having approved application in that manner, the district engineer could not very well hold the contractor to account.

<sup>13</sup> It was explained to the subcommittee that the Korean conflict, creating market scarcities, could not be foreseen at the time the specifications were drawn. However, less expensive materials like asbestos shingles did not disappear from the market after Korea.



The subcommittee was unable to obtain a definitive answer to the question whether the Welchboard was a less expensive material than the striated plywood. Earlier estimates in the district office indicated the Welchboard was slightly cheaper, and the General Accounting Office report made a finding to that effect. Substitution of cheaper materials normally requires a change order adjusting the lump-sum contract price so that the Government might obtain the benefit of any savings in cost arising from the substitution. No change order was executed. The district engineer (who succeeded the one in office when the earlier estimates were made) cited later studies purporting to demonstrate that Welchboard, though cheaper to purchase, was heavier than striated plywood and more costly to transport; also that, as a hard-finish material, it required more meticulous nailing, and so extra labor costs resulted which earlier appraisals had not taken into account. Consequently, the Government did not see cause to execute a change order adjusting the contract price in its favor.

The manner in which this substitute material came to be used suggests a lack of integration and close supervision in the whole process of writing the specifications and supervising their execution on the job.

#### *Omission of cut-off valves*

The subcommittee's attention also was drawn to the fact that on the same two contracts, involving 672 family quarters, cut-off valves had not been installed on convector heating units. Contract specifications permitted contractors the option to furnish and install either cast-iron radiators or convector-type heating units but specifically called for a valve "on the supply to each unit of radiation and convection." The two projects in question required some 6,000 convectors.

Installation of cut-off valves on convectors is desirable not only from the standpoint of having complete control over regulating the heat output from each convector, but also as a matter of convenience and necessity in making repairs and replacements. Without the valves, the heat in the whole building might have to be shut off in repairing a single unit.

Omission of the cut-off valves did not come to the attention of the district engineer until approximately 75 percent of the convectors had been installed. Inspectors did not report their absence, presumably because contract mechanical drawings of the heating system did not show valves on convectors but only on radiators, although a standard provision in the contract stipulates that requirements in the specifications be followed even if not shown in the drawings. It was evident that the inspectors had not been properly schooled as to what to look for and were further handicapped by the lack of the necessary detail in the drawings. The district engineer acknowledged to the subcommittee that—

\* \* \* the field inspection personnel were of the impression that the valves were not required from their study of the plans and from their apparently inadequate knowledge of the specifications.

The chief of the engineering division ventured the observation that it was—

not a solid rule of practice that what is called for in the specification need necessarily be shown on the plan. That is a rule of the contracting game.

The subcommittee suggests that the rule ought to be changed if its practice leads to inadequate inspection by the Government and acrimonious disputes with the contractors as to what should or should not be installed in conformance with contract specifications.

In this case the absence of the detail on the drawings led to a legal controversy about the proper interpretation of the contract. To buttress his position, the contractor sought an opinion from the architect-engineer and was advised informally by a representative of the firm that the architect-engineer had not intended that the valves be installed on the convectors. In the opinion of the chief of the engineering division, this statement was "entirely out of order" and it was flatly rejected by the district office. However, it serves to indicate again the lack of integration between the architect-engineer, the district engineer, and the inspection system in the field.

The convector valves in question were finally installed after repeated insistence by the district engineer. Considerable added expense was entailed by putting in the valves after the plumbing had been completed and, in some cases, the buildings occupied. The contractors have filed claims for recovery.

Although it seems clear to the subcommittee that the specifications govern, as provided in the contracts, making it the contractor's obligation to supply the valves, it would have been a simple matter to write the specifications without leaving any doubt whatever as to their meaning, and to follow up by showing the valve on the convector detail drawing. The subcommittee observes further that the legal responsibility of the contractor is no substitute for rigorous inspection to insure contract performance. By detecting the omission at the outset, the district office might have saved the time and effort that went into the controversy as well as the extra labor and materials required for a belated installation.

#### *Substandard bathtubs*

The tendency of the district engineer to rest with the contractor's responsibility to fulfill specifications was again exemplified in the installation of bathtubs. Although the plumbing specifications call for materials that are "standard in every way, in first-class condition, and the best of their respective makes" and prescribed minimum dimensions, the bathtubs installed in two projects were reputedly the cheapest and lightest weight in the plumbing trade and clearly below required size. These tubs were installed in 35 out of 51 buildings (280 out of 408 dwelling units) on one project before the matter was brought to the attention of the contractor by the district engineer. Deficiencies were not noted until May of 1951, about a year after the plumbing contracts were executed. No inspection of the tubs had been made prior to installation. (Following this episode the district engineer undertook to inspect such materials before their being uncrated.) The brochure submitted by the contractor in advance of installation had failed to show tub dimensions; the adequacy of the bathtub was taken for granted by the district engineer.

Since the installed tubs were cheaper than those called for in the specifications, the Government took a credit of \$4.32 per tub. The contract permitted an option to the contractor to supply either a cast-iron tub or a formed-metal tub of specified minimum dimensions. In figuring what additional charges should be laid upon the contractor

for installing an inferior tub, the district engineer assumed that the contractor would furnish the cheapest tub possible within the specifications. Although this is understandable, it is difficult to understand what purpose was served by including an option to the contractor to supply a cast-iron tub, which is considerably more expensive.<sup>14</sup> One of the district engineer's representatives expressed the opinion that the option to use the cast-iron tub served no purpose in the contract; he stated that he would prefer to take it out of future contracts, but that the option was being retained at the insistence of higher authority. The subcommittee was informed that in a number of the projects, the contractors had supplied cast-iron tubs, which were the only type specified in those particular contracts. In view of the substantial difference in price between cast-iron and formed-metal tubs, where both are permitted as alternatives it would seem advisable to require the submission of alternate bids by contractors.

#### *Defects in waste and vent systems*

In the four contracts examined by the subcommittee, various substitutions, omissions, and deletions in the waste and vent systems had been made by the contractors which resulted in savings in material, labor, and freight. The subcommittee found that these conditions were due in part to the fact that contractors' shop drawings had been approved by the district office even though they did not conform to original contract documents. No change orders had been executed to adjust the lump-sum contract prices. The omission of these details from the drawings, as noted above, does not relieve the contractor from furnishing the materials called for in the plans and specifications. The difficulties in these cases were attributed by the chief of the engineering division to the inexperience of the mechanical engineer who was responsible for making the approvals at a time when the chief of his section was necessarily absent.

The subcommittee observes a disposition on the part of the district engineer to rely too heavily on the contractors' formal responsibility, to be too casual in the acceptance of shop drawings which omit pertinent details, and to be overgenerous in approving modifications, which add to the cost of contract administration. In part these shortcomings lie with the technical divisions within the district office and in part with the inspection system in the field. As far as the contractors are concerned, failure to live up to contract plans and specifications causes them extra expense and difficulties in the end.

#### *Attitude toward contractors*

An easy-going attitude on the part of the district office toward the contractor is bound to impair the general quality of performance. The subcommittee is inclined to agree with the following statement in a report of special inspection dated July 9, 1952, made by a Corps of Engineers officer concerning the Alaska District:

The undersigned felt that in a number of cases the Government is not getting the type of construction nor the quality of material which was provided for in the original contract. Too often deductions from the original amount of the contract were authorized where inspection has detected inferior quality material, and poor workmanship has been passed with no deduction from contract because of the immediate requirement for the facility. It is believed that the tendency to allow

<sup>14</sup> A representative of the Chief of Engineers' Office suggested that the option was for the convenience of contractors who might have a supply of cast-iron tubs in stock.

deductions and to pass inferior workmanship discourages the contractor from meeting specifications and doing top quality work, since he realizes that the maximum penalty he will suffer if detected will be a deduction and if undetected, a net profit over and above his legitimate profit will result.

The district engineer's comment in the same report relative to this observation follows:

No instances can be found where this statement is substantiated. Items of lesser dollar value have been admitted into the contracts, but with foreknowledge prior to incorporation into the work. These were allowed because of procurement difficulties, NPA restrictions which varied from day to day, modifications that entered into the contract at a late date, etc. Where reference to Federal specification was in the slightest degree garbled and advantage was taken thereof by the contractor, the installation of the item was permitted with an equitable adjustment in price, rather than delay the job as the substitution would in no way affect the ultimate functioning of the project. No substitution of an inferior article that would, within knowledge, affect performance was accepted. As in much of the construction, where the completion date was paramount in forming part of an over-all nucleus, substitutions that would maintain the delivery date were permitted.

While the district engineer is putting these matters in the best light, the subcommittee's examination of the housing contracts lends weight to the report of the engineers' inspectorate.

#### *Faulty inspection system*

The importance of having a competent and vigorous inspection system in the field is obvious. The subcommittee has no information as to whether, apart from lack of experience and technical qualifications on the part of field inspectors, other influences are operative to weaken inspection. Undoubtedly there exists a certain amount of persuasion in the form of gifts and gratuities by contractors to induce a friendly attitude. The subcommittee was advised that this is quite normal procedure in construction work and difficult to pin down. Evidently, the problem was getting somewhat out of hand in Alaska, because the report of the engineers' inspector general in July 1952, recommended, among other things, that positive steps be taken to assure compliance with the provisions of Army regulations relative to the giving and receiving of gifts on the part of both district office personnel and contractors. The report noted that although the district engineer had taken very adequate steps to familiarize all personnel concerned with the pertinent regulations, there were indications from the field that some contractors and district office employees were not observing them.

The subcommittee agrees with the recommendation of the engineers' inspector general that the district engineer should reenforce his efforts in this direction and notes that in fact reminders were issued by him to district office personnel in July and August of 1952.

The inspection reports for the housing contracts under investigation for a period of some 9 months in 1950-51 appeared to be only cursory in nature and of little value in determining whether the contractors were performing properly. In April 1951, after a more conscientious and better trained inspector was placed on the job, numerous details of defective performance in the plumbing and heating installations on one project began to show up. In that month a three-man inspection team for the district engineer found that substitutions of inferior materials, omission of specified materials, use of prohibited materials and deliberate deviations from contract plans and specifications



had decreased the cost for the contractor approximately \$125,000. Of this sum, an estimated \$50,000 represented savings in materials, and \$75,000 in decreased labor costs.

#### *Varying credit estimates*

The subcommittee encountered the greatest difficulty in pinning down the amount of credit which the Government considered as properly due from the contractor for failing to live up to contract plans and specifications. As late as February 1952 the district engineer referred to the \$125,000 estimate of the inspection team in making findings of fact with regard to a claim by the contractor. A military officer who served on the team advised the subcommittee in the fall of 1952 that he stood by the original estimate. Refiguring by the district engineer's office resulted in an estimate of \$101,000. The district engineer supplied the latter figure to General Accounting Office representatives on November 15, 1951, in response to a formal request for information on intended action to overcome deficiencies and deviations from the contracts. The district engineer also explained that in addition to the Government taking offsetting credits for deficiencies and deviations that would not seriously affect functional strength, unsatisfactory work would be torn out and replaced by the contractor.

When Chairman Holifield made his inquiry of the Chief of Engineers' office in Washington prior to departure to Alaska, he was given a figure of \$60,000 as the total amount of offsetting credits to the Government in the final modification of the contract in question. During the hearings in Alaska the district engineer stated that he was unable to support that figure; the chief of the construction division stated that it was "taken out of the air." The resident engineer stated also that it was an arbitrary figure which he had formulated as adequate to cover possible credit due from the contractor. A representative of the Chief of Engineers' office who accompanied the subcommittee to Alaska explained that pursuant to Chairman Holifield's query the \$60,000 figure had been obtained by a telephone call to the North Pacific division office in Portland, "and they made an estimate of \$60,000, and that was the best figure they had."

Prior to the subcommittee's visit to Alaska, the district engineer who made the \$101,000 estimate had been replaced by rotation and the engineer now holding the office revealed that their latest calculations had resulted in an estimate of \$10,252 due from the contractor. That figure was supplied to the subcommittee toward the close of its Alaska hearings. It had not been made available to representatives of the General Accounting Office assigned to the subcommittee who had been sent to Alaska a week in advance to review the status of the contracts in question.

In endeavoring to ascertain why the estimates of offsetting credits due the Government made by the preceding district engineer had been deflated some 90 percent, the subcommittee was advised that various cost factors and circumstances confronting the contractor had not been taken into account in the prior estimate. The subcommittee is not in a position to pass upon the multitude of technical details which affect the calculations nor to judge their final validity. However, it is apparent that the estimating function of the district office is faulty at one point or another, and the subcommittee's efforts to obtain an accurate statement concerning offsetting credits

due the Government was met by most unsatisfactory responses on the part of both the Chief of Engineer's office and the district office.

It was pointed out to the subcommittee that the contractor in making good on certain defects insisted upon by the district office had spent from \$200,000 to \$250,000. Claims were submitted in turn by the contractor relative to a number of the disputed items which he was compelled to install and to obtain relief from certain damage penalties imposed. It may very well be when the final settlement is made that the Government will be paying money to the contractor despite the fact that performance on the job was most unsatisfactory, and, in fact, was so poor that the district engineer in November 1952 was moved to write him a sharp letter of reprimand.<sup>15</sup>

#### *Construction problems in Alaska*

In expressing criticism of the district engineer's office for its lax supervision of housing construction contracts under investigation, the subcommittee is mindful of the unusual difficulties of recruiting and maintaining qualified personnel in Alaska. It was emphasized to the subcommittee that the district office was handicapped by the excessive turnover rate in personnel (60 to 72 percent) which made it necessary to spend considerable time in training new recruits. It was pointed out that housing for civilians was poor and in short supply and that living costs in Alaska ranged 50 to 60 percent higher than in the States. Although a 25-percent differential is paid to Government employees to compensate in part for the higher living costs, this differential is considerably reduced by Territorial and Federal income taxes. The lack of schools, churches, community organizations, and other essentials for stable living was also noted.

A lack of engineering data and basic surveys of the Territory, difficult problems of communication and transportation, the high cost of labor, transportation and materials, adverse climatic conditions, and a short construction season were cited as factors which complicate the construction program and the difficulties of supervision.

In the subcommittee's opinion, the costly and difficult nature of construction work in Alaska make it especially incumbent on the Corps of Engineers to exercise the most careful planning and supervision of such work. Contrary to the public impression, the Corps of Engineers is not itself directly engaged in construction work and only a small number of military officers are engaged in the work for which the corps is responsible. It was reported recently that the engineers' organization had 331 military officers and 37,170 civilians involved in the civil-works and military construction activities for the Army and the Air Force.<sup>16</sup> In the Alaska district, as noted above, there were 19 officers and approximately 1,200 civilian Government employees at the time of the subcommittee's visit. On some occasions the number of military officers in the district has been as low as three. This handful of military officers is immediately responsible for an Alaskan construction program currently involving outlays of \$150 million per annum.

The "spreading thin" of military personnel over the huge and far-flung organization administered by the corps has been noted in a recent report of the House Committee on Appropriations.<sup>17</sup> As far as

<sup>15</sup> The letter is printed in the subcommittee hearings, p. 113.

<sup>16</sup> House Committee on Armed Services, hearings (No. 78) on military and naval construction, May-June 1952, p. 3945.

<sup>17</sup> Investigation of Military Public Works (committee print), October 15, 1952.

Alaska is concerned, whether the mere addition of military officers in a supervisory capacity will improve the performance of the district office is a question which the subcommittee has not attempted to answer. That question can only be answered in the context of the larger question whether the Corps of Engineers is the most appropriate agency and is most efficiently organized for the kinds of tasks it is called upon to perform.

#### CONCLUDING SUMMARY AND RECOMMENDATIONS

The subcommittee's attention was drawn to military housing construction in Alaska by reports of poor performance by contractors and lax supervision on the part of the district office of the Corps of Engineers. An investigation was undertaken in cooperation with the General Accounting Office and the subcommittee held hearings in Alaska.

The great volume of postwar military construction in Alaska is concentrated at Ladd and Eielson Air Force Bases in the Fairbanks area and at Elmendorf Air Force Base and Fort Richardson in the Anchorage area. Postwar outlays for all military construction approximate \$750 million and will exceed \$1 billion upon completion. The postwar military housing program represents approximately \$212 million completed, under construction, or programmed, of which \$116 million is for family quarters. This sum makes available 5,096 family units for military families of the Army and Air Force, and represents possibly 55 to 65 percent of the total family housing program.

The Congress has set over-all cost limitations per family unit and has prescribed maximum allowable floor space of 1,080 square feet. Earlier design criteria of the military services have been revised downward to conform to these limitations. A single Alaska architect-engineer firm has designed the family housing which is typically a three-bedroom and basement unit, eight in a row. A few units of lesser size and greater size are being built, though maintaining the over-all 1,080 square feet limitation.

From a review of the background developments in Alaska housing, the subcommittee observes that this program is marked by trial and error and considerable lack of expert knowledge as to the most suitable housing design, materials and construction methods to meet economy demands and military needs. Certain materials specified in the design, lagging construction of utilities, possible excessive excavation in the permafrost area, and failure to take exact account of family needs and available private housing, add up to an uneven approach to economy in Alaska housing.

Examination of specific housing contracts leads the subcommittee to observe that the district engineer tends to rely too heavily on the contractors' formal responsibility, to be too casual in acceptance of shop drawings which omit pertinent details, and to be overgenerous in approving modifications, which add to the cost of contract administration. In part the shortcomings lie with the technical divisions within the district office, and in part with the inspection system in the field.



Following are the subcommittee's recommendations:

1. The basic design for family housing in Alaska should be reexamined by the Corps of Engineers to eliminate specified materials and methods that add to cost without marked effect on functional use.

2. Large quantities of engineer-held construction equipment and other property now lying idle should be promptly identified and moved into other channels of Government use or disposed as surplus.

3. Statutory ceilings on cost and space allowance for Alaska housing units should be reexamined to determine whether they are unnecessarily high.

4. Project planning should be directed to achieving maximum economy. Completion dates for utilities and other housing essentials should be integrated with those of the actual living quarters.

5. Footing problems in the permafrost area should be carefully studied to avoid unrealistic bearing requirements and excessive excavation.

6. The military services should make a reasonable effort to relate housing needs to family size and available private housing in planning for new construction.

7. The possibility of military lease or purchase of the FHA project on military-leased land in the Anchorage area should be examined.

8. Consideration should be given to devising a cost-accounting system that will identify all housing costs, including maintenance.

9. A competent and vigorous inspection system for construction work should be developed in the Alaskan district. The district engineer should reinforce his efforts to prevent the influencing of engineer personnel by contractors' gifts and gratuities.

10. A system for analyzing, pooling, and disseminating information on contract experience should be devised to minimize repetition of costly errors by military personnel subject to rotation of duty.

